

(Revised)
REPORT ON STANDARD
DEFINITIONS
AND
SYMBOLS



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Revised
REPORT ON STANDARDS
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American Institute of Electrical Engineers

No. 2
STANDARD DEFINITIONS AND SYMBOLS

The definitions assembled in this revised Report have been taken largely from the latest approved sections of the A. I. E. E. Standards. In some cases several similar definitions are listed, these differing from each other in varying degrees. It was deemed desirable to again call attention to these inconsistencies in this way in order to expedite the work of standardization of the definitions. Many definitions are now included which were not in the August 1927 edition, as they have been taken from Sections of the Standards approved since that time.

This report is again being circulated widely with a view to obtaining the opinions, criticisms and suggestions of as many interested persons as possible. Suggestions for changes, and criticisms of all parts of the report are in order and are solicited. These should be addressed to the Secretary of the A. I. E. E. Standards Committee, Engineering Societies Building, 33 West 39th Street, New York, N. Y.

A detailed description of the Standards numbering system together with a complete list of the approved A. I. E. E. Standards and identifying numbers, is given on page 4 of this pamphlet.

A list of "Letter Symbols for Electrical Quantities," given on page 56, is the result of the work of a Sectional Committee organized under the procedure of the American Standards Association, is an Institute Standard, and is up for approval as American Standard.

A. I. E. E. DEFINITIONS AND SYMBOLS

Status—Numbering System

The definitions given in this pamphlet represent all the definitions appearing in the approved A. I. E. E. Standards. There is listed also a number of definitions approved by the A. I. E. E. but not appearing in any specific section of the Standards. Such definitions are in every case preceded by the dates *1922 or 1925* according to the year of their approval. Certain of the definitions in the complete listing have in addition to the Institute's approval, received the approval of the American Standards Association and are, therefore American Standards.

A numbering system has been adopted to indicate the source of each individual definition, as well as its status. It may be explained as follows:

1. A definition preceded by hyphenated numbers in bold face Roman type, for example, (**10-50**) is from one of the specific sections into which the A. I. E. E. Standards are now divided.

2. A definition preceded by the hyphenated numbers but in bold face Italic, for example, (***15-52***) is from one of the specific sections of the A. I. E. E. Standards, but has also the status of American Standard or tentative American Standard through approval by American Standards Association.

Where the hyphenated number is used, either in Italic or Roman type, the digit or digits to the left of the hyphen indicate specific Standard source. The figures to the right of the hyphen, the individual definition. A list of the sections into which the Standards are divided is given below with identifying numbers.

3. Definitions preceded by the dates *1922 or 1925* in Italic have the full approval of the Institute but do not occur in any specific section and are only available in printed form in this report.

The titles of the individual sections of the A. I. E. E. Standards together with their identifying numbers are given below:

4. The list of "Letter Symbols for Electrical Quantities" given on page 56 is the work of a Sectional Committee organized under the procedure of the American Standards Association, is an Institute Standard, and is up for approval as American Standard.

No. 1	General Principles upon Which Temperature Limits Are Based in the Rating of Electrical Machinery.	26	Standards for Automatic Stations.
4	Standards for the Measurement of Test Voltages in Dielectric Tests.	30	Standards for Wires and Cables.
5	Standards for Direct-Current Generators and Motors and Direct-Current Commutator Machines in General.	33	Standards for Electrical Measuring Instruments.
7	Standards for Alternators, Synchronous Motors and Synchronous Machines in General.	34	Standards for Telegraphy and Telephony.
*8	Standards for Synchronous Converters.	*36	Standards for Storage Batteries.
9	Standards for Induction Motors and Induction Machines in General.	*37	Standards for Illumination.
10	Standards for Direct-Current and Alternating-Current Fractional Horse Power Motors.	38	Standards for Electric Arc Welding Apparatus.
*11	Standards for Railway Motors.	39	Standards for Electric Resistance Welding Apparatus.
13	Standards for Transformers, Induction Regulators and Reactors.	41	Standards for Insulators.
*14	Standards for Instrument Transformers.	*42	Standard Symbols for Electrical Equipment of Buildings.
*15	Standards for Industrial Control Apparatus.	45	Recommended Practice for Electrical Installations on Shipboard (Marine Rules).
*16	Standards for Railway Control and Mine Locomotive Control Apparatus.	*46	Standards for Hard Drawn Aluminum Conductors.
*17f	Standards for Mathematical Symbols.	*60	Specifications for Tinned Soft or Annealed Copper Wire.
17g1	Standards for Letter Symbols for Electrical Quantities.	*61	Specifications for Soft or Annealed Copper Wire.
17g6	Standards for Graphical Symbols for Telephone and Telegraph Use.	*63	Specifications for 30 Per Cent Rubber Insulation for Wire and Cable for General Purposes.
19	Standards for Oil Circuit Breakers.	*69	Specifications for Cotton Covered Round Copper Magnet Wire.
22	Standards for Disconnecting and Horn Gap Switches.	*70	Specifications for Silk Covered Round Copper Magnet Wire.
		*71	Specifications for Enameled Round Copper Magnet Wire.

*Approved by American Standards Association as American Standard.

Revised Report on Standard Definitions and Symbols

37-76 Abbreviations, Photometric.—See Photometric Units.

37-34 Absorption factor* of a body, a , is the ratio of the flux absorbed by the body to the flux incident upon it.

*See notes to Brightness and Reflection Factor.

19-51 Accessories.—The term accessories is to be used broadly to include both attachments and auxiliaries.

1922* Active Component.—The active component of the current in a circuit is the average power divided by the voltage.

*The active, or in-phase component of the current in a circuit corresponds to average power passing in a given direction through the circuit. With sine wave voltage and current, the active component of the current is in phase with the voltage.

36-102 Active Materials.—Materials of plates reacting chemically to produce electrical energy during the discharge. The active materials of storage cells are restored to their original composition, in the charged condition, by oxidation or reduction processes produced by the charging current. In the charged condition the active materials are as follows:

Plate	Lead Acid Cells	Nickel-iron Alkaline Cells
Positive	Lead peroxide	Oxides of nickel
Negative	Sponge lead	Iron

5-54 Acyclic Machine.—See Unipolar or Acyclic Machine.

5-64, 10-58 Adjustable-Speed Motor.—An adjustable-speed motor is one the speed of which can be varied gradually over a considerable range, but when once adjusted remains practically unaffected by the load, such as a shunt motor designed for a considerable range of speed variation.

26-162 Adjusting Test.—The adjusting test of an automatic station is usually performed in the field after installation is completed and before commercial operation is performed. It consists of first, adjusting the sequence of operation of the devices, and second, adjusting the pick-up and drop-out values of relays as well as their time delay in order to meet the service requirements. The manufacturer shall furnish arrangements

and comprehensive adjusting instructions so that the purchaser may readily adjust the various devices to meet specified conditions.

5-67 Adjustable Varying-Speed Motor.—An adjustable varying-speed motor is one the speed of which can be adjusted gradually, but when once adjusted to a given load will vary in considerable degree with change in load; such as a compound-wound direct-current motor adjusted by field control or a slip ring induction motor with rheostatic speed control.

9-66 Adjustable Varying-Speed Motor.—An adjustable varying-speed motor is one the speed of which can be adjusted gradually, but when once adjusted to a given load will vary in considerable degree with change in load, such as a slip-ring induction motor with rheostatic speed control.

10-61 Adjustable Varying-Speed Motor.—An adjustable varying-speed motor is one the speed of which can be varied gradually over a considerable range, but when once adjusted to a given load varies materially with change in load; such as a slip ring induction motor with rheostatic speed control.

7-55 Advancer, Phase.—See Phase Advancer.

15-109, 16-130 Air (As a Prefix).—The prefix "air" applied to a device which interrupts an electric circuit indicates that the interruption occurs in air.

22-52 Air-Break Switch.—An air-break switch is a switch which breaks the circuit in air. Horn-gap switches and the disconnecting switches covered by the rules in this section are "air-break switches."

34-135 Alarm Signal.—An alarm signal is a sound producing device for attracting attention to either a supervisory or a tell-tale signal.

1-7 Allowance, Conventional.—See Conventional Allowance.

15-104, 16-140 Allowance, Wear.—See Wear Allowance.

1922 Alternating Current.—An alternating current is a current the direction of which reverses at regularly recurring intervals. Unless distinctly otherwise specified, the term *alternating current* refers to a periodically varying current with

- successive half waves of the same shape and area. (See Continuous Current.)
- 1922 Alternating Current Oscillating or Free.**—See Oscillating, or Free Alternating Current.
- 1922 Alternating-Current Simple.**—See Sine-Wave.
- 7-51 Alternator.**—An alternator is a synchronous alternating-current generator, either single phase or polyphase.
- 7-53 Alternator, Polyphase.**—See Polyphase Alternator.
- 7-52 Alternator, Single-Phase.**—See Single-Phase Alternator.
- 7-61 Alternators, Variation in.**—See Variation in Alternators.
- 1922 Ambient Temperature.**—The ambient temperature is the temperature of the air or water which comes into contact with the heated parts of a machine and carries off its heat.
- 36-150 Ampere-Hour Capacity.**—The number of ampere-hours which can be delivered by a cell or battery under specified conditions as to temperature, rate of discharge and final voltage.
- 36-301 Ampere-Hour Efficiency.**—(Electrochemical Efficiency).—The ratio of the ampere-hours output to the ampere-hours of the recharge.
- 14-58 Angle, Phase, of a Current Transformer.**—See Phase Angle of a Current Transformer.
- 14-59 Angle, Phase, of a Potential Transformer.**—See Phase Angle of a Potential Transformer.
- 1922 Angular Velocity.**—See Vector Representation or Angular Velocity.
- 38-62 Anode Drop.**—The voltage drop between the arc stream and the positive electrode.
- 37-75 Apparent candlepower** of an extended source of light is the candlepower of a point source of light which would produce the same illumination at the distance employed.
- 14-63 Apparent Power Factor.**—The apparent power factor in an alternating-current circuit is the power factor calculated from instrument indications after all the necessary corrections have been applied except the correction of the wattmeter reading for the effect of phase displacement of the current and voltage due to the measuring apparatus.
- 1922 Apparent Power or Volt-Amperes.**—The apparent power, or volt-amperes, in an alternating-current circuit is the product of the r. m. s. value of the voltage across the circuit by the r. m. s. value of the current in the circuit. Apparent power is also expressed in kilo-volt-amperes, abbreviated kv-a.
- 38-60 Arc Stream Voltage.**—That voltage across the gaseous zone which varies with the length of the arc.
- 38-77 Arc Systems, Open-Circuit.**—See Open-Circuit Arc System.
- 38-59 Arc Voltage, True.**—See True Arc Voltage.
- 38-58 Arc Voltage, Welding.**—See Welding Arc Voltage.
- 38-54 Arc Welding.**—That process of forming a weld in which an electric arc is utilized to heat to a fluid state the surfaces of the parts to be joined and allowing the metals to flow together (with or without additional molten metal being supplied.)
- 38-55 Arc Welding Electrode.**—A rod or wire which is used to conduct the electric current from the electrode holder to the welding arc,—one end of the electrode forming one terminal of the arc.
- 34-107 Armature Spring.**—An armature spring is the first of a group to be moved by the armature. It may or may not be a main contact spring.
- 16-118 Arrester, Lightning.**—See Lightning Arrester.
- 30-71 Assurance, Factor of.**—See Factor of Assurance.
- 19-52 Attachments.**—Attachments are parts attached to an oil circuit breaker as distinguished from auxiliaries.
- 34-35 Attenuation Constant.**—The attenuation constant for a single frequency is the real part of the propagation constant taken at that frequency.
- 26-53 Automatic Feeder Equipment.**—An automatic feeder equipment is an automatic switching equipment which provides automatic control as defined in **26-50** (Automatic Station) for any type of feeder.
- 34-44 Automatic or Full Mechanical Telephone System.**—An automatic or full mechanical telephone system is one in which the calling party is enabled to complete a call by remote-control switches without the aid of an operator.
- 26-51 Automatic Machine Equipment.**—An automatic machine equipment is an automatic switching equipment which provides automatic control, as defined in **26-50** (Automatic Station) for any type of rotating machine, or rectifier.
- 34-113 Automatic Signaling.**—Automatic signaling is affected without the aid of an operator.
- 15-56 Automatic Starter.**—An automatic starter is a starter designed to automatically control the acceleration of a motor.
- 26-50 Automatic Station.**—An automatic station is an unattended station which, under predetermined conditions, goes into operation by an automatic sequence, which thereupon by automatic means maintains the required character of

- service; which goes out of operation by an automatic sequence, under other predetermined conditions, and which provides protection against all usual operating emergencies.
- 34-114 Automatic Switch.**—An automatic switch is a remote control device for controlling talking or signaling circuits.
- 26-54 Automatic Throw-Over Equipment.**—An automatic throw-over equipment is an automatic switching equipment which automatically connects a load with a source of power selected from one of several incoming lines. One or more lines may be given preference, in which case they are designated as the Preferential Lines, the other lines being designated as the Emergency Lines.
- 26-52 Automatic Transformer Equipment.**—An automatic transformer equipment is an automatic switching equipment which provides automatic control, as defined in **26-50** (Automatic Station) for any type of transformer.
- 19-54, 22-59 Automatic Trip.**—Automatic trip is the opening (other than manually) of an oil circuit breaker due to changes in current or voltage or other electrical conditions.
- 13-101 Auto-Transformer.**—An auto-transformer is a form of transformer that has one continuous winding, part of which is common to both primary and secondary circuits.
- 15-57 Auto-Transformer Starter.**—An auto-transformer starter is a starter having an auto-transformer to furnish a reduced voltage for starting. The device includes the necessary switching mechanism and is frequently called a compensator or auto-starter.
- 19-53 Auxiliaries.**—Auxiliaries are accessories to be used with oil circuit breakers but not attached to them as distinguished from attachments.
- 19-55 Auxiliary Switch.**—An auxiliary switch is a switch actuated by the oil circuit breaker for such duties as signaling, interlocking, etc.
- 1922 Average Power Factor.**—See Momentary and Average Power Factors.
- 36-202 Average Voltage.**—The average value of the voltage during the period of charge or discharge. It is conveniently obtained from the time integral of the voltage curve.
- 22-58 Back-Connected Switch.**—A back-connected switch is a switch in which the current carrying conductors are fastened to the fixed contact blocks in the rear of the mounting.
- 34-111 Back Contact Spring.**—A back contact spring is one against which the main contact spring rests when in the normal position.
- 19-56 Baffle (Deflector).**—A baffle is a device for deflecting oil or gas.
- 1922* Balanced Polyphase Load.**—A balanced polyphase load is a load to which symmetrical currents are supplied when it is connected to a system having symmetrical voltages.
- *The term balanced polyphase load is applied also to a load to which are supplied two currents having the same wave form and r. m. s. value and differing in phase by ninety electrical degrees when it is connected to a quarter-phase (or two-phase) system having voltages of the same wave form and r. m. s. value.
- 1922* Balanced Polyphase System.**—A balanced polyphase system is a polyphase system in which both the currents and voltages are symmetrical.
- *The term balanced polyphase system is applied also to a quarter-phase (or two-phase) system in which the voltages have the same wave form and r. m. s. value and in which the currents have the same wave form and r. m. s. value and differ in phase by ninety electrical degrees.
- 5-61 Balancer, Direct-Current.**—See Direct-Current Compensator or Balancer.
- 34-147 Bank.**—A bank is an assembly of fixed contacts with which the moving members of a selector engage. Banks are usually multiplied.
- 34-123 Bank Cable.**—A bank cable is one which connects a switch bank to a terminal rack.
- 34-122 Bank Wires.**—Bank wires are those wires which multiple adjacent switch banks to each other.
- 19-57 Barrier.**—A barrier is a partition for insulation or isolation of electric circuits or any part thereof.
- 38-51 Base Metal.**—The material which composes the parts to be united by the weld. Unless otherwise expressly stated, it will be understood that a weld joins two pieces of identical material.
- 39-101 Base Metal.**—The material in a weld which composes the parts to be united by the weld. Unless otherwise expressly stated, it will be understood that a weld joins two pieces of identical material.
- 5-65, 10-59 Base Speed of an Adjustable-Speed Motor.**—The base speed of an adjustable-speed motor is the lowest speed obtained at rated load with rated voltage across the armature at the temperature attained at operation under rated load for the time specified in the rating.
- 16-53 Basic Functions.**—By "basic functions" is usually meant such operations as acceleration, line closing, reversing, etc.
- 36-53 Batteries, Portable.**—See Portable Batteries.
- 36-52 Batteries, Stationary.**—See Stationary Batteries.
- 16-106 Battery, Control.**—See Control Battery.
- 36-100 Battery, Storage.**—See Storage Battery.
- 19-58 Bell Alarm Switch.**—A bell alarm switch is a switch controlled either by the automatic opening of a breaker or by buckling the toggle manually and designed to close the circuits to a bell or other audible signaling device.

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- 19-59 Bell Crank.** A bell crank is a rectangular lever by which the direction of motion is changed through an angle.
- 22-71 Blade Latch.**—A blade latch is a latch used on a switch to hold the switch blade in the closed position.
- 22-65 Blade, Trussed Switch.**—See Trussed Switch Blade.
- 16-115 Bolt, Insulated.**—See Insulated Bolt.
- 36-254 Boost Charge.**—A partial charge, usually at a high rate for a short period.
- 5-53 Booster.**—A booster is a generator inserted in series in a circuit to change its voltage. A booster may be driven by an electric motor (in which case it is termed a motor-booster) or otherwise.
- 8-53 Booster Converter, Synchronous.**—See Synchronous Booster Converter.
- 16-96 Box, Junction.**—See Junction Box.
- 16-97 Box, Pull or Transfer.**—See Pull or Transfer Box.
- 16-86 Bow Trolley.**—A bow trolley is a trolley, the collecting member of which is a bow, mounted on a frame or pole.
- 15-113 Brake, Magnet.**—See Magnet Brake.
- 16-141 Break.**—The break of a circuit opening device is the minimum distance between the stationary and movable contacts when these contacts are in the open position.
- 34-127 Break Impulse.**—A break impulse is an impulse due to a temporary interruption of current.
- 10-55 Breakdown Torque.**—See Pull Out or Breakdown Torque.
- 16-69 Breaker, Line.**—See Line Breaker.
- 34-158 Bridge Duplex.**—A bridge duplex is a duplex system in which the receiving instruments at each station are connected across two impedances, one in series with the line wire and the other in series with the artificial line in such manner that no electrical change in the receiver circuit is effected by outgoing signals.
- 37-14 The Brightness*** in a given direction of a surface emitting light is the quotient of the luminous intensity measured in that direction by the area of this surface projected on a plane perpendicular to the direction considered.
- *Nos. 37-14, 18, 19, 20, 31, 34, 35, 46, 66, 67, 68, 70 and 71 are in accordance with definitions adopted by the International Commission on Illumination in 1924.
- 37-52 Brightness ratio** is the ratio of the brightness of any two surfaces. When the two surfaces are opposed, the brightness ratio is commonly called the "brightness contrast."
- 37-15 Brightness, Units of.**—See Units of Brightness.
- 14-55 Burden, Secondary.**—See Secondary Burden.
- 19-60 Bushing.**—A bushing is the part insulating a through conductor.
- Exception:* When the conductor is built into the bushing this term covers the complete insulating unit, including conductor, support and other parts.
- 16-95 Bus Line.**—A bus line is a continuous electric circuit other than the electric train line, extending through two or more vehicles to serve as a source of electric energy. It is usually used to supply energy to the main motor circuit.
- 34-85 "Busy."**—"Busy" is the condition of a line or an apparatus when it is in use.
- 39-103 Butt Welding.**—A form of resistance welding in which the parts to be welded are brought into contact under pressure after which current is caused to flow from one part to the other across the area of contact, raising the metals to a welding temperature and the weld is completed by the application of pressure at the surfaces. The entire area of the surfaces in contact is welded at one time.
- 16-90, 30-54 Cable.**—A cable is either a stranded conductor (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).
- 30-59 Cable, Concentric-Lay.**—See Concentric-Lay Cable.
- 30-62 Cable, Duplex.**—See Duplex Cable.
- 30-61 Cable, N-Conductor Concentric.**—See N-Conductor Concentric Cable.
- 30-60 Cable, N-Conductor.**—See N-Conductor Cable.
- 30-58 Cable, Rope-Lay.**—See Rope-Lay Conductor.
- 30-67 Cable, Sector.**—See Sector Cable.
- 30-70 Cable, Shielded Conductor.**—See Shielded Conductor Cable.
- 30-69 Cable, Split Conductor.**—See Split Conductor Cable.
- 30-66 Cable, Triplex.**—See Triplex Cable.
- 30-63 Cable, Twin.**—See Twin Cable.
- 19-61 Calibration.**—A calibration is a set of graduations marked to indicate values such as current, voltage or time at which an automatic trip device can be set to operate.
- 34-82 Called Party.**—A called party is the person who answers when a station is called.
- 34-80 Calling Device.**—A calling device is an apparatus by means of which automatic switches are controlled for the purpose of establishing a connection.
- 34-81 Calling Party.**—A calling party is a person who originates a telephone call.

- 16-67 Cam Contactor or Cam Switch.**—A cam contactor or cam switch is one actuated by a cam.
- 37-6 Candle, International.** See International Candle.
- 37-7 Candlepower** is luminous intensity expressed in candles.
- 37-75 Candlepower, Apparent.**—See Apparent Candlepower.
- 37-68 Candlepower, Mean Hemispherical.**—See Mean Hemispherical Candlepower.
- 37-66 Candlepower, Mean Horizontal.**—See Mean Horizontal Candlepower.
- 37-67 Candlepower, Mean Spherical.**—See Mean Spherical Candlepower.
- 37-69 Candlepower, Mean Zonal.**—See Mean Zonal Candlepower.
- 1922 Capability.**—See Capacity.
- 1925 Capacitor** (to denote the device sometimes called "static-condenser").
- A capacitor is a device used primarily because it possesses the property of electrical capacitance.
- 1922 Capacity (or Property, Capability).**—The word "capacity" is frequently used in the general sense of "capability." It is also used in a more exact sense to denote the load which, when carried by a machine, apparatus, or device will, under specified conditions of test, cause it to reach *any one of its physical limitations*, such for example, as operating temperature or ability to maintain required voltage.
- Capacity should be distinguished from rating. On account of the different senses in which it has been employed (see **Rating**) capacity is less used than it formerly was, rating being more useful commercially.
- 36-150 Capacity, Ampere-Hour.**—See Ampere-Hour Capacity.
- 36-352 Capacity, Temperature Coefficient of.**—See Temperature Coefficient of Capacity.
- 36-151 Capacity, Watt-Hour.**—See Watt-Hour Capacity.
- 38-57 Carbon Electrode Welding.**—That arc welding process in which the electrode is of carbon, either amorphous or graphic, and any filling metal in the weld must be supplied by a filling rod or by metal in another form.
- 8-54, 9-56 Cascade Converter.**—A cascade converter (also called a motor converter) is a combination of an induction motor with a synchronous converter, the secondary circuit of the former feeding directly into the armature of the latter; *i. e.*, a synchronous converter concatenated with an induction motor.
- 36-113 Case.**—A container for several cells. Specifically wood cases are containers for cells in individual jars; rubber or composition cases are provided with compartments for the cells.
- 38-61 Cathode Drop.**—The voltage drop between the arc stream and the negative electrode.
- 19-63 Cell.**—A cell is a compartment for isolated circuit breakers or parts thereof.
- 22-66 Cell.**—A cell is a compartment to isolate disconnecting switches or other switching equipment.
- 36-116 Cell Connector.**—A conductor used for carrying current between adjacent cells.
- 19-64 Cell Doors.**—Cell doors are doors for closing the front or rear of a cell.
- 22-67 Cell Doors.**—A cell door is a door for closing the front or rear of a cell.
- 36-119 Cell, Pilot.**—See Pilot Cell.
- 36-101 Cell, Storage.**—See Storage Cell.
- 19-65, 22-68 Cell Structures.**—A cell structure is a set of compartments to house switching equipment.
- 36-117 Cells, Counter.**—See Counter Electromotive Force Cells.
- 36-118 Cells, End.**—See End Cells.
- 16-76 (d) Center Contact Rail.** A center contact rail is a contact rail placed between the track rails, customarily having its contact surface above the level of the top of the track rails.
- 34-48 Central Office (British "Exchange").**—A central office is a switching center for inter-connecting lines terminating therein.
- 16-71 Changeover Switch.***—A changeover switch is a switching device for changing electrical circuits from one combination to another.
- *It is usual to qualify the term changeover switch by stating the purpose for which it is used, such as series-parallel changeover switch, trolley-shoe changeover switch.
- 37-63 Characteristic curve** is a curve expressing a relation between two variable properties of a luminous source, as candlepower and volts, candlepower and rate of fuel consumption, etc.
- 34-32* Characteristic Impedance.**—The characteristic impedance of a line is the ratio of the applied electromotive force to the resulting steady-state current upon a line of infinite length and uniform structure, or of periodic recurrent structure.
- *In practise, the terms (1) line impedance, (2) surge impedance, (3) iterative impedance, (4) sending-end impedance, (5) initial sending-end impedance, (6) final sending-end impedance, (7) natural impedance and (8) free impedance, have apparently been more or less indefinitely and indiscriminately used as synonyms with what is here defined as "characteristic impedance."
- Single frequency voltages and currents are here supposed to be represented by complex numbers. Their ratio is therefore a complex number.
- 36-250 Charge.**—The conversion of electrical energy

For description of numbering system, see page 4

into chemical energy within the cell or battery. This consists of the restoration of the active materials by passing a uni-directional current through the cell or battery in the opposite direction to that of the discharge. A cell or battery which is said to be "charged" is understood to be fully charged.

36-254 Charge, Boost.—See Boost Charge.

36-252 Charge, Constant-Current.—See Constant-Current Charge.

36-253 Charge, Constant Voltage.—See Constant Voltage Charge.

36-255 Charge, Equalizing.—See Equalizing Charge.

36-256 Charge, Trickle.—See Trickle Charge.

36-251 Charging Rate.—The current expressed in amperes at which a battery is charged.

16-68 Circuit Breaker.—A circuit breaker is a device (other than a fuse) constructed primarily for the interruption of a circuit under infrequent abnormal conditions.

19-50 Circuit Breaker, Oil.—See Oil Circuit Breaker.

19-104 Circuit Breakers, Interrupting Rating of Oil.—See Interrupting Rating of Oil Circuit Breakers.

26-106 Circuit Closing Capacity.—The circuit closing capacity of devices in automatic switching equipments shall be the maximum current which the device can close successfully at rated voltage with a prescribed operating cycle.

13-402 Circuit, Directly Grounded.—See Directly Grounded Circuit.

1922 Circuit, Electric.—See Electric Circuit.

26-105 Circuit Interrupting Capacity.—The circuit interrupting capacity of devices in automatic switching equipments shall be the maximum current which the device can interrupt successfully at rated voltage with a prescribed operating cycle.

1922 Circuit, Polyphase.—See Polyphase Circuit.

1922 Circuit, Quarter-Phase or Two-Phase.—See Quarter-Phase or Two-Phase Circuit.

1922 Circuit, Single-Phase.—See Single-Phase Circuit.

1922 Circuit, Six-Phase.—See Six-Phase Circuit.

1922 Circuit, Three-Phase.—See Three-Phase Circuit.

13-119 Circuit Voltage Rated.—See Rated Circuit Voltage.

33-101 Circuits of an Instrument, Rating of the.—See Rating of the Circuits of an Instrument.

30-73 Circular Mil.*—A circular mil is a unit of area

equal to $\frac{\pi}{4} = (0.7854 \dots)$ of a square mil.

The cross-sectional area of a circle in circular mils is therefore equal to the square of its diameter in mils. A circular inch is equal to one million circular mils.

*A mil is the one-thousandth part of an inch. There are 1974 circular mils in a square millimeter.

5-154, 7-153, 8-152, 9-153, 10-152, 11-151, 14-152, 15-202, 16-206, 19-152, 33-154, 38-153, 39-204 Class A Insulation Defined.—Class A insulation consists of cotton, silk, paper and similar organic materials when impregnated* or immersed in oil; also enamel as applied to conductors.

*See Impregnated.

5-155, 7-154, 8-153, 9-154, 11-152, 13-203, 15-203, 16-207, 19-153, 33-154, 38-154, 39-205 Class B Insulation Defined.—Class B insulation consists of inorganic materials such as mica and asbestos in built-up form combined with binding substances. If Class A material is used in small quantities in conjunction for structural purposes only, the combined material may be considered as Class B, provided the electrical and mechanical properties of the insulated winding are not impaired by the application of the temperature permitted for Class B material. (The word "impair" is here used in the sense of causing any change which could disqualify the insulating material for continuous service.)

7-155, 13-204, 15-204, 16-208, 39-206 Class C Insulation Defined.—Class C insulation consists of inorganic materials such as pure mica, porcelain, quartz, etc.

5-153, 9-152, 10-151, 14-151, 15-201, 16-205, 19-151, 33-152 Class O Insulation Defined.—Class O insulation consists of cotton, silk, paper and similar organic materials when neither impregnated* nor immersed in oil.

*See Impregnated.

22-63 Clearance between Poles, Minimum.—See Minimum Clearance between Poles.

22-62 Clearance on One Pole, Minimum.—See Minimum Clearance on one Pole.

22-64 Clearance to Ground, Minimum.—See Minimum Clearance to Ground.

19-66, 22-69 Clevis.—A clevis is a fitting having a "U" shaped end and arranged for attaching to the end of a pipe or rod.

22-60 Clip, Contact.—See Contact Clip.

22-61 Clip, Hinge.—See Hinge-Clip.

38-76 Closed-Circuit Arc System.—A system in which the circuit is normally closed and the arcs are extinguished by paralleling them with substitute circuits.

- 36-201 Closed-Circuit Voltage.**—The voltage at the terminals of a cell or battery when current is flowing.
- 26-106 Closing Capacity, Circuit.**—See Circuit Closing Capacity.
- 38-65 Coated Electrodes.**—Metallic electrodes, which are coated with suitable fluxing materials applied either by painting, spraying, dipping or otherwise treating the wire.
- 34-140* Coefficient of Coupling of a Transformer.**—The coefficient of coupling of a transformer at a given frequency is the ratio of the mutual impedance between the primary and secondary of the transformer, to the square root of the product of the self-impedance of the primary and of the secondary.
- *Single frequency voltages and currents are here supposed to be represented by complex numbers. Their ratio is therefore a complex number.
- 37-39 Coefficient of utilization** of an illumination installation on a given plane is the total flux received by that plane divided by the total flux from the lamps illuminating it. When not otherwise specified, the plane of reference is assumed to be a horizontal plane 30 inches (76 cm.) from the floor.
- 34-27* Coil Loading.**—A coil loading is one in which the normal inductance is altered by the insertion of lumped inductance in the circuit at intervals.
- *This lumped inductance may be applied either in series or in shunt.
- As commonly understood, coil loading is a series loading, in which the lumped inductance is applied at uniformly spaced recurring intervals.
- 16-78 Collector, Current.**—See Current Collector.
- 16-79 Collector, Overhead Rail.**—See Overhead Rail Collector.
- 16-80 Collector, Third Rail.**—See Third Rail Collector.
- 16-82 Collector, Underground.**—See Underground Collector or Plow.
- 37-24 Color of luminous flux** is the subjective evaluation by the eye of the quality of luminous flux. Any color can be expressed in terms of its hue and saturation.
- 37-27 Color, Saturation of a.** See Saturation of a Color.
- 34-69 Combination Current.**—A combination current consists of two or more currents of different characteristics in the same circuit. As ordinarily used the term refers to currents whose characteristics are steadily maintained, as for example, a combination of direct current and an alternating current.
- 41-8 Combined Mechanical and Electrical Strength.**—The combined mechanical and electrical strength of an insulator is the load in pounds at which the insulator fails either electrically or mechanically, voltage and mechanical stress being applied simultaneously as described under "Combined Mechanical and Electrical Strength Test." (41-154).
- 5-50 Commutating Machines, Direct-Current.**—See Direct Current Commutating Machines.
- 5-254 etc., Commutation, Successful.**—See Successful Commutation.
- 37-60 Comparison Lamp** is a lamp of constant but not necessarily known candlepower against which a working standard and test lamps are successively compared in a photometer.
- 33-15 Compensator, Line-Drop Voltmeter.**—See Line Drop Voltmeter Compensator.
- 5-61 Compensator or Balancer, Direct Current.**—See Direct Current Compensator.
- 37-26 Complementary Hues.**—See Two Hues, etc.
- 1922 Component, Active.**—See Active Component.
- 1922 Component, Reactive.**—See Reactive Component.
- 38-67 Composite Electrodes.**—Metallic electrodes in which one or more conducting materials, with flux if desired, are combined mechanically.
- 34-22 Composite Line.**—A composite line is a line consisting of a plurality of successive sections having different linear electrical constants, as in the case where an underground cable section is joined to an overhead open-wire section.
- 34-10 Compositing Circuit.**—A compositing circuit is a two-wire telephone circuit, arranged for the superposition on each of its component metallic conductors, of a single independent ground-return signaling circuit.
- 34-154 Concentrator.**—A concentrator is a traffic distributing device by means of which a number of telegraph or telephone lines, and connections to operating instruments are brought together at one point to facilitate their interconnection at such times as signals or messages are to be transmitted from one to the other.
- 30-61 Concentric Cable, N-Conductor.**—See N-Conductor Concentric Cable.
- 30-59 Concentric-Lay Cable.**—A concentric-lay cable is either:
- (a) A concentric-lay conductor as defined in 30-57. (Concentric-Lay Conductor).
 - (b) A multiple-conductor cable composed of a central core surrounded by one or more layers of helically laid insulated conductors.
- 30-57 Concentric-Lay Conductor.***—A concentric lay conductor is a conductor composed of a central

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core surrounded by one or more layers of helically laid wires.

*In the most common type of concentric-lay conductor, all wires are of the same size and the central core is a single wire.

1925 Condenser, Static.—See Capacitor.

7-56 Condenser, Synchronous.—See Synchronous Condenser.

1922 Condensive Load.—A condensive load is a reactive load in which the current leads the voltage across the load.

15-111, 16-108, 19-67, 22-72 Conducting Parts.—Conducting parts (of control apparatus) are those designed to carry current or which are conductively connected therewith.

16-88 Conductor.—A wire, or combination of wires, not insulated from one another, suitable for carrying a single electric circuit.

30-51 Conductor.—A conductor is a wire or combination of wires not insulated from one another, suitable for carrying electric current.

30-57 Conductor, Concentric-Lay.—See Concentric-Lay Conductor.

16-75 Conductor, Contact.—See Contact Conductors.

15-66 Conductor, Resistive.—See Resistive Conductor.

30-58 Conductor, Rope-Lay.—See Rope-Lay Conductor.

30-68 Conductor, Round.—See Round Conductor.

30-52 Conductor Stranded.—See Stranded Conductor.

1922 Connected Load.—The connected load on any system, or part of a system, is the combined continuous rating of all the receiving apparatus on consumers' premises which is connected to the system, or part of the system under consideration.

16-100 Connection Strap.—A connection strap is a short separate connecting conductor used to join one or more electric circuits.

36-116 Connector, Cell.—See Cell Connector.

34-118 Connector Switch or Final Selector.—A connector switch or final selector is a switch whose duty is to establish a connection with the called line. It is usually operated by the last digit or digits of the call number.

16-98 Connectors.—A connector is a device attached to two or more wires or cables for the purpose of connecting electric circuits without the use of permanent splices.

36-252 Constant-Current Charge.—A charge in which the current is maintained at constant value. For some types of lead batteries this may involve two rates called the starting and the finishing rates.

38-83 Constant-Current Welding Source.—A source which, when adjusted to give rated current output with normal arc voltage, will automatically maintain this current output within 5 per cent of the rated value with a variation in arc voltage of 10 per cent above or below the normal arc voltage and has a time of recovery of not more than 0.3 seconds.

36-25 Constant-Potential Charge.—A charge in which the voltage at the terminals of the battery is held at a constant value. A modified constant potential system is one in which a fixed resistance is inserted in the charging circuit to limit the initial current.

38-84 Constant-Power Welding Source.—A source which when adjusted to give rated power output with normal arc voltage will automatically maintain this power output within 5 per cent of the rated value with a variation in arc voltage of 10 per cent above or below the normal arc voltage and has a time of recovery of not more than 0.3 second.

5-62, 9-63, 10-56 Constant-Speed Motor.—A constant-speed motor is one the speed of which is either constant or does not materially vary; such as a synchronous motor, an induction motor with small slip, or a direct-current shunt motor.

15-69 Constant Torque Resistor.—A constant torque resistor is a resistor for use in the armature or rotor circuit of a motor in which the current remains practically constant throughout the entire speed range.

36-253 Constant Voltage Charge.—A charge in which the voltage at the terminals of the battery is held at a constant value. A modified constant voltage system is usually one in which the voltage of the charging circuit is held substantially constant, but a fixed resistance is inserted in the battery circuit producing a rising voltage characteristic at the battery terminals as the charge progresses. This term is also applied to other methods for producing automatically a similar characteristic.

38-81 Constant Voltage Welding Source.—A source which automatically maintains its voltage within 5 per cent of the rated full-load setting over the range from full load to no load and has a time of recovery of not more than 0.3 seconds.

34-36 Constant, Wave-Length.—See Wave Length Constant.

15-117 Construction Diagram, Controller.—See Controller Construction Diagram.

37-48 Consumption, Specific.—See Specific Consumption.

16-110 Contact.—A contact is a surface common to

- two conducting parts, united by pressure for the purpose of carrying current.
- 15-58, 19-68, 22-73 Contact.**—A contact is a conducting part designed to be united by pressure to another conducting part for the purpose of carrying current.
- 22-60 Contact Clip.**—The contact clip is the clip which the switch-blade enters or embraces.
- 16-75 Contact Conductors.**—A contact conductor is that part of the distribution system other than the traffic rails, which is in immediate electrical contact with current collectors of the cars or locomotives.
- 16-76 Contact Rail.**—(a) *General:* A contact rail is a metal rail used as a contact conductor.
- 34-105 Contact Spring.**—A contact spring is one which takes an electrical part in switching a circuit.
- 16-111, 19-69, 22-74 Contact Surface.**—A contact surface is a surface common to two conducting parts united by pressure for the purpose of carrying current.
- 16-76 Contact Rail, Center.**—See Center Contact Rail.
- 16-76 Contact Rail, Overhead.**—See Overhead Contact Rail.
- 16-76 Contactor Rail, Underground.**—See Underground Contact Rail.
- 39-106 Contact Welding, Pressure.**—See Pressure Contact Welding.
- 15-63 Contactor.**—A contactor is a device for repeatedly establishing and interrupting an electric power circuit.
- 16-67 Contactor, Cam.**—See Cam Contactor.
- 16-64 Contactor or Unit Switch.**—A contactor or unit switch is a device for repeatedly establishing and interrupting an electric power circuit under normal conditions.
- 1922 Continuous Current.**—A continuous current is a practically non-pulsating direct-current.
- 5-88, 7-87, 8-60, 9-88, 10-82, 13-120, 15-121, 16-145, 38-86, 39-109 Continuous Duty.**—Continuous duty is a requirement of service that demands operation at substantially constant load for an unlimited period.
- 34-26 Continuous Loading.**—A continuous loading is a series loading in which the added inductance is uniformly distributed along the conductors.
- 5-101, 7-101, 8-101, 9-101, 10-101, 13-151, 15-151, 16-151, 38-101, 39-151 Continuous Rating.**—The continuous rating defines the load which can be carried for an unlimited period, without causing any of the limitations established herein to be exceeded.
- 26-101 Continuous Rating.**—The continuous rating defines the load which may be carried by the various devices in the equipment for an unlimited period without causing any of the limitations established herein to be exceeded.
- 11-102 Continuous Rating of Ventilated Motors.**—The continuous rating of a ventilated railway motor shall be the output at the motor shaft measured in horse power (or kilowatts) which the motor can carry for an unlimited period on stand test, at its rated voltage and frequency (in the case of alternating-current motor), with the ventilation system as in service without exceeding the temperature limits given in Table II, Section 11. Direct-current ventilated railway motors may also be given a continuous rating in amperes at full, three-fourths and half rated voltage.
- 16-106 Control Battery.**—A control battery is one used as a source of control energy supply for a controller.
- 15-114 Control Circuit Transformer.**—A control circuit transformer is a voltage transformer utilized to supply a voltage suitable for the operation of shunt coil magnetic devices.
- 16-61 Control Cutout Switch.**—A control cutout switch is a disconnecting switch that isolates the control circuit of a motor controller from the train line.
- 15-119 Control Sequence Table.**—A control sequence table is a table indicating the connecting devices that are closed for each successive position of the controller.
- 16-59 Control Switch.***—A control switch is one for making or breaking a control circuit.
- *Control switches derive their name from the function of the apparatus that they control, such as master control switches, reset switches, etc.
- 19-62 Control Switch.**—A control switch is a switch usually manually operated for controlling electrically operated switches and circuit breakers.
- 15-117 Controller Construction Diagram.**—A controller construction diagram is a diagram indicating the physical arrangement of parts such as wiring, busses, resistor units, etc.
- Example: A diagram showing the arrangement of grids and terminals in a grid type resistor.
- 15-118 Controller, Diagram, Elementary.**—See Elementary Controller Diagram.
- 15-54, 16-56 Controller, Drum.**—See Drum Controller.
- 15-120 Controller, Duty of.**—See Duty of a Controller.
- 15-50, 16-50 Controller, Electric.**—See Electric Controller.
- 16-54 Controller, Electro-Pneumatic.**—See Electro-Pneumatic Controller.

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- 15-51 Controller, Full Magnetic.**—See Full Magnetic Controller.
- 16-53 Controller, Magnetic.**—See Magnetic Controller.
- 16-52 Controller, Master.**—See Master Controller.
- 16-51 Controller, Motor.**—See Motor Controller.
- 15-52 Controller, Semi-Magnetic.**—See Semi-Magnetic Controller.
- 15-123 Controller, Service of a.**—See Service of a Controller.
- 15-116 Controller Wiring Diagram, External.**—See External Controller Wiring Diagram.
- 15-115 Controller Wiring Diagram.**—A controller wiring diagram is a diagram showing the electrical connections between the parts comprising the controller, and indicating the external connections.
- 1-7 Conventional Allowance.**—A specified number of degrees which, FOR PURPOSES OF STANDARDIZATION, is the margin fixed between the limiting hottest spot and the limiting observable temperatures.
- 5-351, 7-451, 8-401, 9-301, 13-301, 38-201 Conventional Efficiency.**—The efficiency is obtained from the component losses, most of which are accurately determinable and the remainder of which are assigned conventional values; or all of the losses may be determined by conventional methods of test. The efficiency determined in this way is the ratio of the output to the sum of the output and the losses, or of the input minus the losses to the input.
- 11-201 (a) Conventional Efficiency:** The efficiency is obtained from the component losses, most of which are accurately determinable and the remainder of which are assigned conventional values. The efficiency determined in this way is the ratio of the output to the sum of the output and the losses, or of the input minus the losses to the input.
- 37-76 Conversion Factors, Photometric.**—See Photometric Units.
- 5-57, 8-50, 9-55 Converter.**—A converter is a machine which employs mechanical rotation in changing electrical energy from one form into another.
- 8-54, 9-56 Converter, Cascade.**—See Cascade Converter.
- 5-58 Converter, Direct-Current.**—See Direct Current Converter.
- 8-52 Converter, Field Control.**—See Field Control Converter.
- 7-57, 9-57 Converter, Frequency.**—See Frequency Converter.
- 9-58 Converter, Induction Frequency.**—See Induction Frequency Converter.
- 8-51 Converter, Synchronous.**—See Synchronous Converter.
- 8-53 Converter, Synchronous Booster.**—See Synchronous Booster Converter.
- 30-56 Cord.***—A cord is a small, very flexible insulated cable.
- *There is no sharp dividing line in respect to size between a "cord" and a "cable."
- 14-60 Correction Factor, Phase Angle.**—See Phase Angle Correction Factor.
- 14-61 Correction Factor, Ratio.**—See Ratio Correction Factor.
- 33-32 Correction, Instrument.**—See Error and Correction.
- 1922* Counter-Clockwise Convention.**—It is recommended that, in any vector diagram, the leading vector be drawn counter-clockwise with respect to the lagging vector, as in Fig. 3-1 where OI represents the vector of a current in a simple alternating-current circuit lagging behind the vector OE of impressed electromotive force.
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- *See Publication 12 of the International Electrotechnical Commission (Report of Turin meeting, Sept. 1911, p. 78.)
- 36-117 Counter Electromotive Force Cells.**—Cells of practically no capacity used to oppose the line voltage. Frequently called "Counter cells."
- 36-110 Couple.**—The element of a cell containing two plates, one positive and one negative. This term is also applied to a positive and negative plate connected together as one unit for installation in adjacent cells.
- 16-93 Coupler Socket or Receptacle.**—A coupler socket or receptacle is the fixed portion of the train line coupler.
- 16-92 Coupler, Train Line.**—See Train Line Coupler.
- 38-66 Covered Electrodes.**—Metallic electrodes which are covered with a wrapping or braiding of paper, asbestos or other material. A coating of flux may be included with the covering.
- 19-59 Crank, Bell.**—See Bell Crank.
- 1922* Crest Factor or Peak Factor.**—The crest factor or peak factor of a wave is the ratio of the crest, or maximum, value to the r. m. s. value.
- *The crest factor of a sine wave is $\sqrt{2}$.
- 33-13 Crest Voltmeter.**—A crest voltmeter is a voltmeter depending for its indications upon the crest, or maximum value of the voltage of the system to which it is connected. Crest voltmeters should be clearly marked on the instrument proper whether readings are in r. m. s. values or in true crest volts. It is preferred that the marking should be r. m. s. values of the sinusoidal wave having the same crest value.

- 36-353 Critical Temperature.**—The temperature of the electrolyte at which an abrupt change in capacity occurs.
- 1922 Current, Alternating.**—See Alternating Current.
- 33-6 Current Circuit of an Instrument.**—The current circuit of an instrument is that winding of the instrument proper which carries the current to be measured, or a definite fraction of it, or a current dependent upon it.
- 13-110 Current of a Constant-Potential Transformer, Rated Secondary.**—See Rated Secondary Current of a Constant-Potential Transformer.
- 1922 Current, Continuous.**—See Continuous Current.
- 16-78 Current Collector.**—A current collector is a device which maintains electrical contact between the contact conductor and the electric circuit of a vehicle, and provides means for current to flow from one to the other.
- 1922 Current, Direct.**—See Direct Current.
- 15-108, 16-144 Current, Drop-Out.**—See Drop-Out Voltage (or Current.)
- 13-105 Current Limiting Reactor.**—A current limiting reactor is a form of reactor intended to limit the current that can flow in a circuit under short circuit.
- 34-163 Current Margin.**—In a non-polar simplex system, the difference between the current flowing through a receiving instrument when operated to that flowing when not operated.
- 15-105, 16-142 Current, Pick-Up.**—See Pick-Up Voltage.
- 1922 Current, Pulsating.**—See Pulsating Current.
- 14-101 Current, Rated Primary of a Current Transformer.**—See Rated Primary Current of a Current Transformer.
- 19-108 Current Rating, Short-Time.**—See Short-Time Current Rating.
- 15-78, 16-124 Current Relay.**—A current relay is one that functions at a predetermined value of current. A current relay may be either an over-current relay or an under-current relay.
- 15-106, 16-143 Current, Sealing.**—See Sealing Voltage (or Current.)
- 1922 Currents, Symmetrical.**—See Symmetrical Voltages and Currents.
- 14-50 Current Transformer.**—A current transformer is a transformer designed to have its primary winding connected in series with a circuit carrying the current to be measured or controlled.
- 14-58 Current Transformer, Phase Angle of a.**—See Phase Angle of a Current Transformer.
- 37-63 Curve, Characteristic (of a Luminous Source).**—See Characteristic Curve.
- 37-64 Curve, Horizontal Distribution.**—See Horizontal Distribution Curve.
- 37-22 Curve, Luminosity.**—See Luminosity Curve.
- 37-62 Curve, Performance.**—See Performance Curve.
- 37-65 Curve, Vertical Distribution.**—See Vertical Distribution Curve.
- 34-102 Cut-Off Relay.**—A cut-off relay is one which when operated disconnects from a line apparatus normally connected to it.
- 16-60 Cutout Switch, Motor.**—See Motor Cutout Switch.
- 1922 Cycle.**—A cycle is one complete set of positive and negative values of an alternating current.
- 19-105 Cycle, Unit Operating.**—See Unit Operating Cycle.
- 33-26 Damping.**—This is a term applied to instrument performance to denote the manner in which the pointer settles to its steady indication after a sudden change in the value of the measured quantity. Two general classes of damped motion are distinguished; namely, (a) periodic, in which the pointer oscillates about the final position before coming to rest; (b) aperiodic, in which the pointer comes to rest without overshooting the rest position. The point of change between periodic and aperiodic damping is called critical damping.
- 34-29* Damping Constant.**—The damping constant of a circuit is a measure of the ratio of the dissipative to the reactive component of its admittance or impedance.
- *Applied to the admittance of a condenser or other simple circuit having capacity reactance, the damping constant for a harmonic electromotive force of given frequency is the ratio of the conductance, G , of the condenser or simple circuit at that frequency to twice the capacitance, C , of the condenser at the same frequency, $(G/2C)$.
- Applied to the reactance of a coil or other simple circuit having inductive reactance, the damping constant for a harmonic current of a given frequency is the ratio of the resistance, R , of the coil or circuit at that frequency to twice the inductance, L , at the same frequency, $(R/2L)$.
- 33-27 Damping Factor.**—Damping factor is the ratio of the angular deviations of the pointer in two successive swings from the position of equilibrium.
- 34-28 Damping of a Circuit.**—The damping at a given point in a circuit from which the source of energy has been withdrawn, is the progressive diminution in the effective value of electromotive force and current at that point resulting from the withdrawal of electrical energy.
- 16-112 Deadman's Handle.***—A deadman's handle is a controller handle arranged to automatically cause the interruption of the power supply to the

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main motors when the operator removes his hand from the handle.

*The deadman's handle may have combined with it an emergency brake feature. This latter automatically applied the air brakes to the train when the deadman's handle is released.

15-88 Definite Time.—A qualifying term applied to any relay indicating that there is purposely introduced a delay in action, which delay remains substantially constant regardless of the magnitude of the quantity that causes the relay to function. (For quantities slightly above the minimum operating value, the delay may be inverse.)

19-56 Deflector.—See Baffle.

7-65 Degree, Electrical.—See Electrical Degree.

1922 Demand Factor.—The demand factor of any system, or part of a system, is the ratio of the maximum demand of the system, or part of a system, to the total connected load of the system, or of the part of the system under consideration.

1922 Demand of an Installation or System.—The demand of an installation or system is the load which is drawn from the source of supply at the receiving terminals averaged over a suitable and specified interval of time. Demand is expressed in kilowatts, kilovolt-amperes, amperes, or other suitable units.

1922 Demand, Maximum.—See Maximum Demand.

7-650, 14-257 Deviation Factor of a Wave Defined.—The deviation factor of a wave is the ratio of the maximum difference between corresponding ordinates of the wave and of the equivalent sine wave to the maximum ordinate of the equivalent sine wave when the waves are superposed in such a way as to make this maximum difference as small as possible.

15-117 Diagram, Controller Construction.—See Controller Construction Diagram.

15-115 Diagram, Controller Wiring.—See Controller Wiring Diagram.

15-118 Diagram, Elementary Controller.—See Elementary Controller Diagram.

15-116 Diagram, External Controller Wiring.—See External Controller Wiring Diagram.

16-102 Diagram, Schematic Wiring.—See Schematic Wiring Diagram.

16-101 Diagram, Wiring.—See Wiring Diagram.

1922 Difference, Equivalent Phase.—See Equivalent Phase Difference.

1922 Difference, Phase; Lead and Lag.—See Phase Difference; Lead and Lag.

34-157 Differential Duplex.—A differential duplex is a duplex system in which at each station one of two portions of the receiving instrument are con-

nected in series with the line wire and the other in series with an artificial line of such electrical characteristics that the effects upon the receiver of currents passing through the main and artificial lines, as a result of outgoing signals, are neutralized.

15-81*, 16-126 Differential Relay.—A differential relay is one that functions by reason of the difference between two quantities such as current or voltage.

*This term includes relays heretofore known as "ratio balance relays," "biased relays" and "percentage differential relays."

37-33 Diffuse reflection factor of a body is the ratio of the diffusely reflected flux to the incident flux.

37-38 Diffused illumination is that produced either by primary or secondary light sources having dimensions relatively large with respect to the distance from the point illuminated, and scattering light in all directions. It is characterized by relative lack of shadow. Diffused illumination may be derived principally from a single direction as in the light from a skylit window, or from all directions as in the open air. Perfectly diffused illumination on a surface is shadowless.

In any practical case of illumination on a surface there is usually a mixture of the above types.

37-28 Diffusing surfaces and media are those which break up the incident flux and distribute it more or less in accordance with the cosine law, as for example, white plaster and opal glass.

34-14 Duplex Circuit.—A duplex circuit in telegraphy is one arranged for the simultaneous transmission of two messages in the same direction.

1922 Direct Current.—A direct current is a unidirectional current. As ordinarily used, the term designates a practically non-pulsating current.

5-50 Direct-Current Commutating Machines.—A direct-current commutating machine comprises a magnetic field of constant polarity, an armature, and a commutator connected therewith. Specific types of direct-current commutating machines are: Direct-current Generators, Direct-current Motors, Direct-current Boosters and Dynamotors, Direct-current Compensators or Balancers, and Arc Machines.

5-61 Direct-Current Compensator or Balancer.—A direct-current compensator or balancer is a machine which comprises two or more similar direct-current machines (usually with shunt or compound excitation) directly coupled to each other and connected in series across the outer conductors of a multiple-wire system of distribution, for the purpose of maintaining the potentials of the intermediate wires of the

- system, which are connected to the junction points between the machines.
- 5-58 Direct-Current Converter.**—A direct-current converter is a machine which converts from a direct-current to a direct-current, usually with a change of voltage. Such a machine may be either a motor-generator set or a dynamotor.
- 34-153 Direct-Point Repeater.**—A direct-point repeater is a repeater in which the receiving relay controlled by the signals received over a line repeats these signals into another line or lines without the interposition of any other repeating or transmitting apparatus.
- 30-75 Direction of Lay.**—The direction of lay is the lateral direction in which the strands of a cable run over the top of the cable as they recede from an observer looking along the axis of the cable.
- 13-402 Directly Grounded Circuit.**—A circuit shall be considered *directly grounded* when transformer connections and characteristics are such that not less than twice the combined rated line currents from the bank or banks of transformers supplying the circuit will flow to ground when a line is grounded at a terminal of any of the transformers supplying the circuit.
- 5-351, 7-451, 8-401 Directly Measured Efficiency.**—The efficiency is obtained from simultaneous measurements of input and output or by an accurate determination of all the component losses.
- 9-301, 38-201 Directly Measured Efficiency.**—The efficiency is obtained from simultaneous measurements of input and output.
- 36-258 Discharge.**—The conversion of the chemical energy of the battery into electrical energy.
- 36-260 Discharge, Self.**—See Local Action.
- 15-60 Disconnecting Switch.**—A disconnecting switch is a switch which is intended to open a circuit only after the load has been thrown off by some other means.
- 16-58 Disconnecting Switch.**—A disconnecting switch is for isolating a circuit. It is intended to be opened only after the load has been disconnected by some other means.
- 22-53 Disconnecting Switch.**—A disconnecting switch is a form of a knife switch used primarily to isolate apparatus for inspection or repair or as a transfer switch so that the circuit connections may be changed. It is a switch for opening the circuit only after the main current has been interrupted by other means.
- 22-56 Disconnecting Switch, Double Throw.**—See Double Throw, Disconnecting Switch.
- 22-54 Disconnecting Switch, Horn-Gap.**—See Horn-Gap Disconnecting Switch.
- 22-55 Disconnection Switch, Single-Throw.**—See Single-Throw Disconnecting Switch.
- 37-64 Distribution Curve, Horizontal.**—See Horizontal Distribution Curve.
- 37-65 Distribution Curve, Vertical.**—See Vertical Distribution Curve.
- 1922 Diversity Factor.**—The diversity factor of any system, or part of a system, is the ratio of the sum of the maximum power demands of the subdivisions of the system, or part of a system, to the maximum demand of the whole system, or part of the system under consideration, measured at the point of supply.
- 5-52 Double-Current Generator.**—A double-current generator is a machine which supplies both direct and alternating currents from the same armature-winding.
- 22-56 Double-Throw Disconnecting Switch.**—A double throw disconnecting switch is a disconnecting switch by which a change in circuit connections can be obtained by moving the switch blade or blades through an angle (usually 180 deg.) with the hinge clip or clips as a center.
- 13-160 Double and Triple Voltage Ratings, Normal Voltage Rating of Transformers Having.**—See Normal Voltage Rating, etc.
- 13-158 Double Voltage Rating.**—A transformer having a double voltage rating is one which has two separate windings (primary and secondary) with two voltage ratings assigned to each, the turn ratio being the same for both ratings.
- 37-73 The Downward flux** is the flux emitted by the source below the horizontal plane passing through its center.
- 5-76, 7-75, 9-76, 10-70, 16-137, 19-76, 22-81 Drip-Proof Apparatus (Machine or Motor).**—Drip-proof apparatus is apparatus so (constructed or) protected as to exclude falling moisture or dirt. Drip-proof apparatus may be either open or semi-enclosed if it is provided with suitable protection integral with the apparatus, or so enclosed as to exclude, effectively, falling solid or liquid material.
- 15-96 Dip-Tight Apparatus.**—Drip-tight apparatus is apparatus so protected as to exclude falling moisture or dirt. Drip-tight apparatus may be semi-enclosed apparatus if it is provided with suitable protection integral with the apparatus, or so enclosed as to exclude effectively falling solid or liquid material.
- 15-108, 16-144 Drop-Out Voltage (or Current).**—The drop-out voltage (or current) is the voltage (or current) at which the contacts of a magnetic contactor open under conditions of normal operating temperature.

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- 38-62 Drop, Anode.**—See Anode Drop.
- 38-61 Drop, Cathode.**—See Cathode Drop.
- 38-63 Drop, Electrode.**—See Electrode Drop.
- 7-64, 13-116 Drop, Impedance.**—See Impedance Drop.
- 7-63, 13-115 Drop, Reactance.**—See Reactance Drop.
- 15-54*, 16-56 Drum Controller.**—A drum controller is a controller that utilizes a drum switch as the main switching element.
- *A drum controller usually consists of a drum switch and a resistor.
- 15-61, 16-62 Drum Switch.**—A drum switch is a switch having electrical connecting parts in the form of fingers, held by spring pressure against contact segments or surfaces on the periphery of a rotating cylinder or sector.
- 41-5 Dry Flashover Voltage.**—Dry flashover voltage is the voltage at which the air surrounding a clean dry insulator or shell breaks down between electrodes, with the formation of a sustained arc, the test being made as described under "Dry Flashover Test."
- 30-62 Duplex Cable.***—A duplex cable is a cable composed of two insulated stranded conductors twisted together.
- *They may or may not have a common insulating covering.
- 34-13 Duplex Circuit.**—A duplex circuit in telegraphy is one arranged for simultaneous operation in opposite directions.
- *5-75, 7-74, 9-75, 10-69, 15-94, 16-136, 19-75, 22-80 Dust-Proof Apparatus, (Machine or Motor).**—Dust-proof apparatus is apparatus so constructed or protected that the accumulation of dust will not interfere with its successful operation.
- 33-41 A Dust-Proof instrument** is provided with a case which excludes dust from the mechanism.
- *5-74, 7-73, 9-74, 10-68, 15-95, 16-135, 19-74, 22-79 Dust-Tight Apparatus, (Machine or Motor).**—Dust-tight apparatus is apparatus so constructed that the enclosing case will exclude dust.
- 5-88, etc. Duty, Continuous.**—See Continuous Duty.
- 15-120 Duty of a Controller.**—The duty of a controller means the specific function or functions that it is designed to accomplish with respect to the operation of the motor; such as, starting, speed control, reversing and stopping; and, in addition, the frequency and length of time of operation.
- 5-90, etc. Duty, Intermittent.**—See Intermittent Duty.
- 5-91, etc. Duty, Periodic.**—See Periodic Duty.
- 7-104, etc. Duty, Ratings for Intermittent, Periodic and Varying Duty.**—See Ratings for Intermittent Periodic and Varying Duty.
- 5-89, etc. Duty, Short Time.**—See Short Time Duty.
- 33-35 Dynamometer Instruments.**—See Electrodynamic Instruments.
- 5-59, 16-104 Dynamotor.**—A dynamotor is a transforming device combining both motor and generator action in one magnetic field, either with two armatures, or with one armature having two separate windings and independent commutators.
- 5-58 Dynamotor.**—See Direct-Current Converter.
- 36-300 Efficiency.**—The ratio of the output of a cell or battery to the input required to restore the initial state of charge under specified conditions of temperature, current rate, and final voltage.
- 36-301 Efficiency, Ampere-Hour.**—See Ampere-Hour Efficiency.
- 5-350, 7-450, 8-400, 9-300, 10-350, 13-300, 38-200 Efficiency Defined.**—The efficiency of an apparatus (machine, or motor) is the ratio of the useful power output to the total power input.
- 11-200 Efficiency Defined.**—The efficiency of a railway motor is the ratio of the power output at the motor shaft to the power input at the motor terminals.
- 36-303 Efficiency, Energy.**—See Watt-Hour Efficiency.
- 37-22 Efficiency, Luminous.**—See Luminous Efficiency.
- 1922 Efficiency, Plant or System.**—See Plant or System Efficiency.
- 37-46 The Efficiency of a Source*** is the ratio of the total luminous flux to the total power consumed. In the case of an electric lamp it is expressed in lumens per watt. In the case of a source depending upon combustion it may be expressed in lumens per thermal unit consumed per unit of time.
- *See note to Brightness.
- 36-302 Efficiency, Volt.**—See Volt Efficiency.
- 36-303 Efficiency, Watt-Hour.**—See Watt-Hour Efficiency.
- 1922 Effective Value.**—See Root-Mean Square or Effective Value.
- 1922 Electric Circuit.**—An electric circuit is a path in which an electric current may flow. Strictly speaking, an electric circuit is a complete circulatory path, but the term circuit is commonly employed to designate a specific part of a complete path. When part of a complete path is referred to, such as a branch circuit, a derived circuit, or a conductor, both the terminals and the conductor which form that path should be specified in order to avoid ambiguity; *e. g.*, the circuit *a-b-c*. When the whole circuit is referred to, it may be designated as a complete or closed circuit.
- 15-50, 16-50 Electric Controller.**—An electric controller is a device, or group of devices, which serves to govern, in some predetermined manner the